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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/US96/17520</p> <p>(22) International Filing Date: 4 November 1996 (04.11.96)</p> <p>(71) Applicant (for all designated States except US): THE PROCTER &amp; GAMBLE COMPANY [US/US]; One Procter &amp; Gamble Plaza, Cincinnati, OH 45202 (US).</p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): UCHIYAMA, Hirotaka; 5-8-17-3B, Nishiokamoto, Higashinada-ku, Kobe 658 (JP). MOSS, Brett, Kenneth; 95 Bettington Road, Oatlands, NSW 2117 (AU).</p> <p>(74) Agents: REED, T., David et al.; The Procter &amp; Gamble Company, 5299 Spring Grove Avenue, Cincinnati, OH 45217 (US).</p>		<p>(81) Designated States: BR, CN, JP, MX, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE),</p> <p>Published With international search report.</p>
<p>(54) Title: HAIR MOUSSE COMPOSITION COMPRISING SILICONE EMULSION</p> <p>(57) Abstract</p> <p>Disclosed are hair mousse compositions comprising a silicone emulsion comprising a silicone polymer selected from the group consisting of a polyalkyl siloxane having a molecular weight of at least 20,000, a polyaryl siloxane having a molecular weight of at least 20,000, and amino-substituted siloxane having a molecular weight of at least 5,000, a silicone resin having a molecular weight of at least 5,000, and mixtures thereof, an anionic surfactant, a compatibilizing surfactant, and a cationic surfactant, wherein the silicone polymer is dispersed as a particle having an average size of not more than 450 nm; a styling polymer; and additional surfactant, and a solvent.</p>		

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## HAIR MOUSSE COMPOSITION COMPRISING SILICONE EMULSION

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### TECHNICAL FIELD

The present invention relates to a hair mousse composition comprising a silicone emulsion.

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### BACKGROUND

Leave-on foaming cosmetic compositions for hair are usually referred to as "mousses", which term will be used in the present invention. Hair mousses were born in Europe in the early 1980s. Hair mousses are fundamentally an aerosol foam, however, non-aerosol foams are also known. The general appeal of hair mousses can be largely attributed to the ease of application and controlled amount of product which are possible from mousse formulations. Hair mousse compositions are generally dispensed by a compressible dispenser or a valve and applied to the user's hand or a specifically designed comb and spread through the hair. Alternatively, hair mousse compositions can be directly applied to the hair by dispensing through nozzles. Hair mousses are formulated for the purpose of styling, setting, and arranging, or for other purposes such as shampooing, conditioning, treating, dyeing, and combinations thereof.

20

In recent years, some consumers have expressed a desire to have hair mousse products which can provide both styling and conditioning benefits. Materials which can provide improved conditioning benefits are silicone conditioning agents such as silicone polymers. Silicone polymers having high molecular weight are particularly known to provide favorable conditioning benefits such as smoothness and combing ease. However, these high molecular weight silicone polymers tend to have a large particle size and are thermodynamically unstable. Mechanical shearing is known to provide smaller particle size of fluids. High molecular weight silicone polymers are too viscous to emulsify down to a desirable particle size. Thus, high molecular weight silicone polymers could not be formulated at levels that would provide desired conditioning benefits.

30

Further, the unstableness seen in mousse compositions comprising high molecular weight silicone polymers is particularly noticeable for compositions which comprise certain organic solvents and/or propellants.

5 Solvents which may render the composition unstable are volatile primary alcohols having 1 to 6 carbons, particularly ethanol. However, alcohol may be used in mousse compositions for ease of formulation or for ease of application of the product to the hair.

10 Propellants which may render the composition unstable are fluorocarbons and hydrocarbons such as LPG, and dimethyl ether. Among these, LPG (liquified petroleum gas) is a mixture of mainly iso-butene, n-butene, and propane, and is known to be relatively safe.

Therefore, there remains a desire to provide a mousse composition which provides improved conditioning benefits, and is stable with a wide range of solvents and propellants.

15 Japanese Patent Laid-open 5-163122 discloses hair cosmetics comprising a dimethylpolysiloxane microemulsion obtained by emulsion polymerization, a dimethylpolysiloxane polyoxyalkylene copolymer, and water. United States Patent 5,504,149 discloses a method for making a silicone emulsion having high viscosity wherein a mixture of water, cyclic siloxane, optional nonionic surfactant  
20 and cationic surfactant is polymerized by using silanolate or organosilanolate as an initiator.

In the present invention, a hair mousse composition comprising a silicone emulsion comprising a high molecular weight silicone polymer made via a certain surfactant system have been developed which provides improved conditioning  
25 benefits such as smoothness, softness, decreased stickiness or stiffness, and which can be used with a wide range of solvents and propellants.

#### SUMMARY

The present invention relates to a hair mousse composition comprising by weight of the concentrate:

30 (a) a silicone emulsion comprising:

- i) from about 0.01% to about 20% of the concentrate a silicone polymer selected from the group consisting of a polyalkyl siloxane having a molecular weight of at least 20,000, a polyaryl siloxane having a molecular weight of at least 20,000, an amino-substituted siloxane

having a molecular weight of at least 5,000, a silicone resin having a molecular weight of at least 5,000, and mixtures thereof;

- ii) an anionic surfactant;
- iii) a compatibilizing surfactant; and
- iv) a cationic surfactant;

wherein the silicone polymer is dispersed as a particle having an average size of not more than about 450 nm;

(b) from about 0.5% to about 15% of a styling polymer;

(c) from about 0.1% to about 15% of an additional surfactant; and

(d) from about 60% to about 99% of a solvent comprising by weight of solvent at least about 80% water.

Such compositions satisfy the need for a hair mousse composition which has improved conditioning benefits and which are stable in a wide range of solvents and propellants.

#### DETAILED DESCRIPTION

All percentages herein are by weight of the compositions unless otherwise indicated. All ratios are weight ratios unless otherwise indicated. The total of components except for propellant is hereinafter defined as a "Concentrate". For non-aerosol products containing no propellant, the concentrate is equal to the entire composition. All percentages, ratios, and levels of ingredients referred to herein are based on the actual amount of the ingredient, and do not include solvents, fillers, or other materials with which the ingredient may be combined as commercially available products, unless otherwise indicated.

The invention hereof can comprise, consist of, or consist essentially of the essential elements described herein as well as any of the preferred or optional ingredients also described herein.

All publications, patent applications, and issued patents mentioned herein are hereby incorporated in their entirety by reference.

#### SILICONE EMULSION

The hair mousse composition of the present invention comprises a silicone emulsion comprising a silicone polymer, an anionic surfactant; a compatibilizing surfactant, and a cationic surfactant. The silicone emulsion is prepared by emulsion polymerization, wherein an aqueous solution or emulsion of the starting silicone material is mixed with an anionic surfactant, followed by addition of a compatibilizing surfactant, and finally by addition of a cationic surfactant. The



starting silicone material is selected so that the resulting silicone polymer in the obtained silicone emulsion has more than a certain molecular weight, and dispersed as a particle having an average size of not more than about 450 nm, more preferably about from 150 nm to about 250 nm. Silicone polymers having such particle size make a silicone emulsion which is stable with a wide range of components.

A convenient and useful method of preparing the silicone emulsion of the present invention is by utilizing the following procedure:

1) blending a mixture of starting silicone material selected from the group consisting of cyclic silicone oligomers such as cyclic dimethyl siloxanes known as cyclomethicone, mixed silicone hydrolyzates, silanol stopped oligomers, higher molecular weight silicone polymers, functionalized silicones and mixtures thereof; with water and anionic surfactants;

2) heating the blend obtained by mixing the starting silicone material, water and anionic surfactant to a temperature ranging from about 75 to about 98 °C for a period of time ranging from about 1 to about 5 hours;

3) cooling the anionically emulsion polymerized silicone emulsion to temperature ranging from 0 to about 25 °C for a period of time ranging from about 3 hours to about 24 hours;

4) adding a compatibilizing surfactant; and

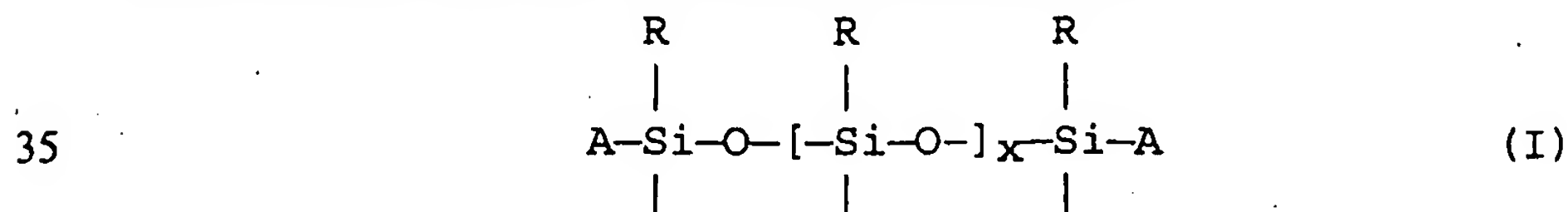
5) adding a cationic surfactant.

The silicone polymer is comprised at a level of from about 0.01% to about 20%, more preferably from about 0.1% to about 10% of the concentrate.

#### Silicone Polymer

The silicone polymer of the present invention are those which provide excellent conditioning benefits to the hair. The silicone polymer is selected from the group consisting of a polyalkyl siloxane having a molecular weight of at least 20,000, a polyaryl siloxane having a molecular weight of at least 20,000, an amino-substituted siloxane having a molecular weight of at least 5,000, a silicone resin having a molecular weight of at least 5,000, and mixtures thereof.

The polyalkyl siloxanes and polyaryl siloxanes useful as silicone polymers herein include those with the following structure (I):



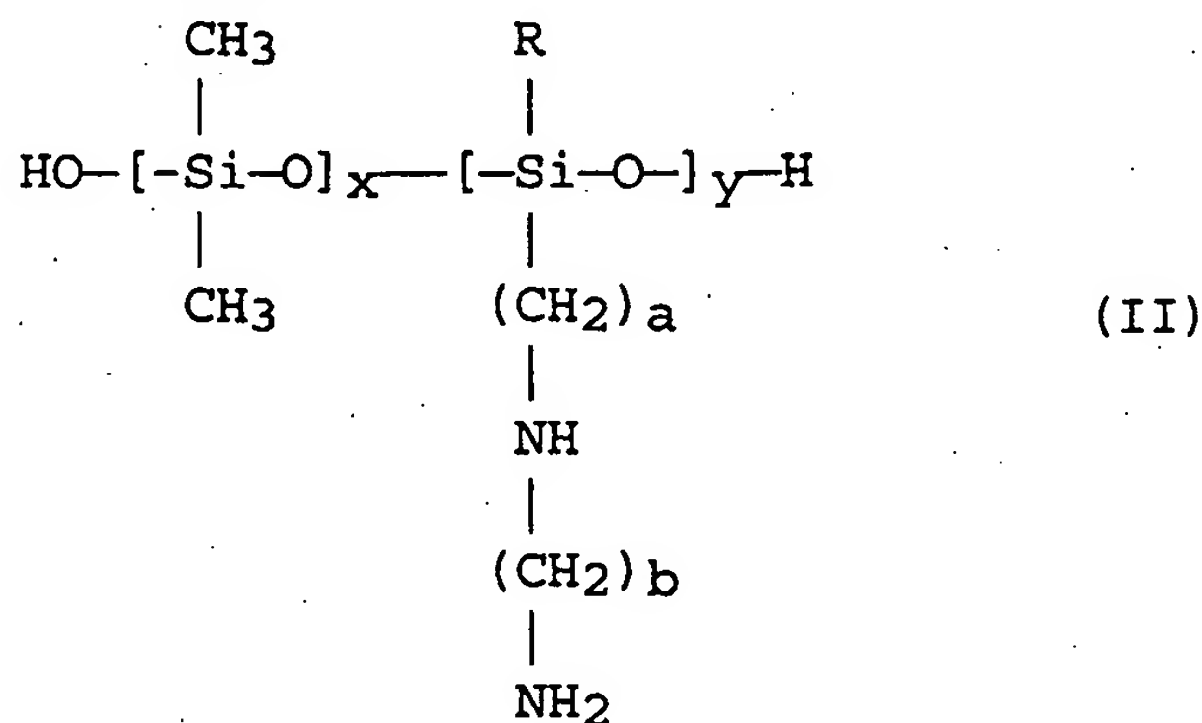


R            R            R

wherein R is alkyl or aryl, and x is an integer from about 200 to about 8,000 having a molecular weight of at least 20,000, more preferably at least 100,000, still more preferably at least 200,000. "A" represents groups which block the ends of the silicone chains. The alkyl or aryl groups substituted on the siloxane chain (R) or at the ends of the siloxane chains (A) can have any structure as long as the resulting silicone is dispersible, is neither irritating, toxic nor otherwise harmful when applied to the hair, is compatible with the other components of the composition, is chemically stable under normal use and storage conditions, and is capable of being deposited on and conditions the hair. Suitable A groups include hydroxy, methyl, methoxy, ethoxy, propoxy, and aryloxy. The two R groups on the silicon atom may represent the same group or different groups. Preferably, the two R groups represent the same group. Suitable R groups include methyl, ethyl, propyl, phenyl, methylphenyl and phenylmethyl. The preferred polyalkyl and polyaryl silicone polymers are polydimethylsiloxane, polydiethylsiloxane, polymethylphenylsiloxane, and derivatives thereof terminated with hydroxy and carboxyl groups. Polydimethylsiloxane, which is also known as dimethicone, and its hydroxyl terminated derivative, which is also known as dimethiconol, are especially preferred.

Also useful herein, for enhancing the shine characteristics of hair, are highly arylated silicones, such as highly phenylated polyethyl silicone having refractive indices of about 1.46 or higher, especially about 1.52 or higher. When these high refractive index silicones are used, they should be mixed with a spreading agent, such as a surfactant or a silicone resin, as described below to decrease the surface tension and enhance the film forming ability of the material.

The amino-substituted siloxanes useful as silicone polymers herein include those with the following structure (II):

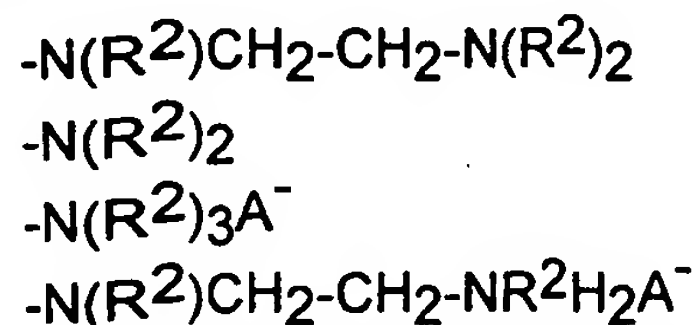


wherein R is CH<sub>3</sub> or OH, x and y are independent integers which depend on the desired molecular weight wherein y is not 0, a and b are independent integers from 1 to 10, and wherein the average molecular weight is at least 5,000, more preferably at least 10,000. This polymer is also known as amodimethicone.

5 Suitable amino-substituted siloxanes include those represented by the formula (III)

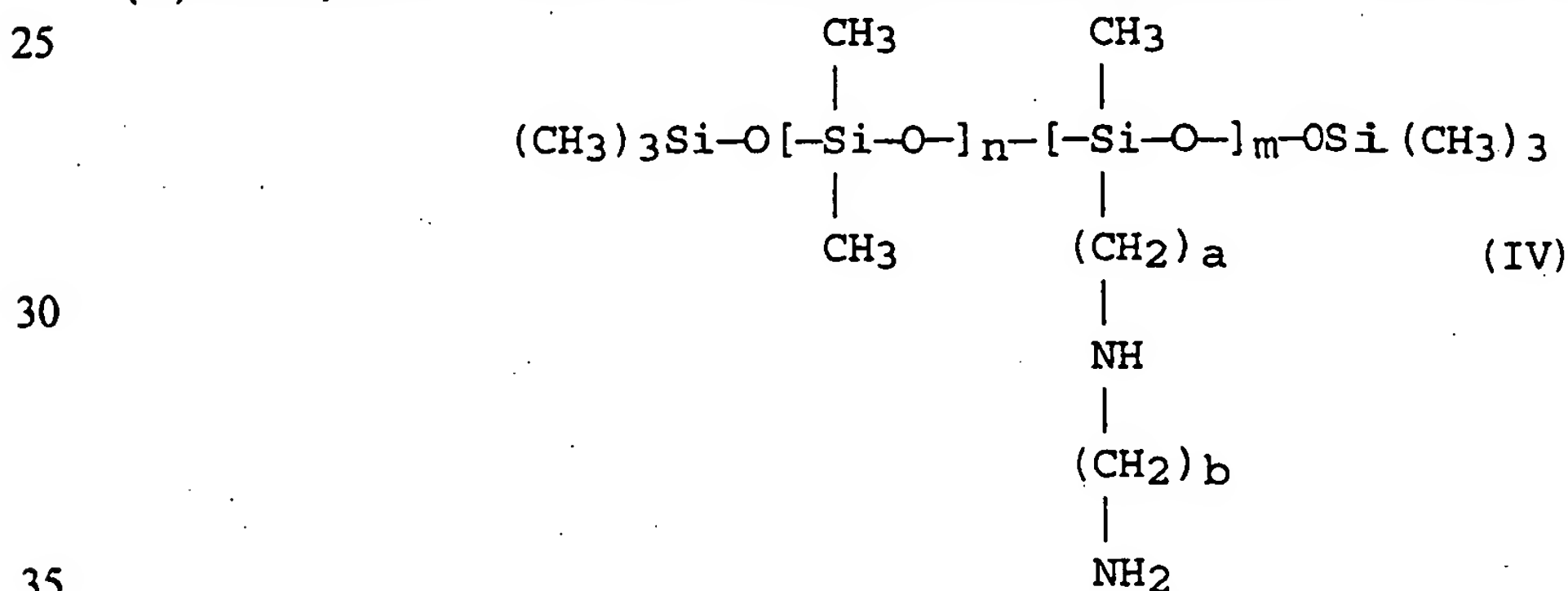


wherein G is chosen from the group consisting of hydrogen, phenyl, OH, C<sub>1</sub>-C<sub>8</sub> alkyl and preferably methyl; a denotes 0 or an integer from 1 to 3, and preferably equals 0; b denotes 0 or 1 and preferably equals 1; the sum n+m is a number from 1 to 2,000 and preferably from 50 to 150, n being able to denote a number from 0 to 1,999 and preferably from 49 to 149 and m being able to denote an integer from 1 to 2,000 and preferably from 1 to 10; R<sup>1</sup> is a monovalent radical of formula C<sub>q</sub>H<sub>2q</sub>L in which q is an integer from 2 to 8 and L is chosen from the groups



20 in which R<sup>2</sup> is chosen from the group consisting of hydrogen, phenyl, benzyl, a saturated hydrocarbon radical, preferably an alkyl radical containing from 1 to 20 carbon atoms, and A<sup>-</sup> denotes a halide ion.

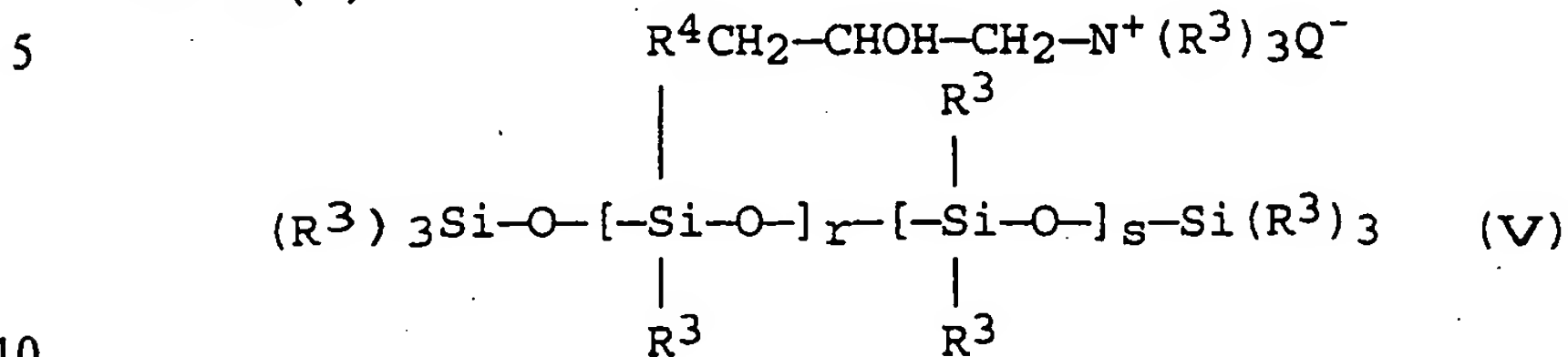
An especially preferred amino-substituted siloxane corresponding to formula (III) is the polymer known as "trimethylsilylamodimethicone", of formula (IV):



wherein n and m are independent integers of 1 or more selected depending on the desired molecular weight, a and b are independent integers from 1 to 10, and

wherein the average molecular weight is at least 5,000, more preferably at least 10,000.

Other amino-substituted siloxanes which can be used are represented by the formula (V):



wherein  $\text{R}^3$  denotes a monovalent hydrocarbon radical having from 1 to 18 carbon atoms, preferably an alkyl or alkenyl radical such as methyl;  $\text{R}^4$  denotes a hydrocarbon radical, preferably a  $\text{C}_1\text{--C}_{18}$  alkylene radical or a  $\text{C}_1\text{--C}_{18}$ , and more preferably  $\text{C}_1\text{--C}_8$ , alkyleneoxy radical; Q is a halide, preferably chloride; r denotes an average value from 2 to 20, preferably from 2 to 8; s denotes an average value from 20 to 200, and preferably from 20 to 50.

Also useful are silicone resins, which are highly crosslinked polymeric siloxane systems, having a molecular weight of at least 5,000, preferably at least 10,000. The cross-linking is introduced through the incorporation of trifunctional and tetrafunctional silanes with monofunctional or difunctional, or both, silanes during manufacture of the silicone resin. As is well understood in the art, the degree of crosslinking that is required in order to result in a silicone resin will vary according to the specific silane units incorporated into the silicone resin. In general, silicone materials which have a sufficient level of trifunctional and tetrafunctional siloxane monomer units, and hence, a sufficient level of crosslinking, such that they dry down to a rigid, or hard, film are considered to be silicone resins. The ratio of oxygen atoms to silicon atoms is indicative of the level of crosslinking in a particular silicone material. Silicone materials which have at least about 1.1 oxygen atoms per silicon atom will generally be silicone resins herein. Preferably, the ratio of oxygen:silicon atoms is at least about 1.2:1.0. Silanes used in the manufacture of silicone resins include monomethyl-, dimethyl-, trimethyl-, monophenyl-, diphenyl-, methylphenyl-, monovinyl-, and methylvinyl-chlorosilanes, and tetrachlorosilane, with the methyl-substituted silanes being most commonly utilized. Without being bound by theory, it is believed that the silicone resins can enhance deposition of other silicones on the hair and can enhance the glossiness of hair with high refractive index volumes.

Other useful silicone resins are silicone resin powders such as the material given the CTFA designation polymethylsilsequioxane.

Silicone resins can conveniently be identified according to a shorthand nomenclature system well known to those skilled in the art as the "MDTQ" nomenclature. Under this system, the silicone is described according to the presence of various siloxane monomer units which make up the silicone. Briefly, the symbol M denotes the monofunctional unit  $(\text{CH}_3)_3\text{SiO}_{0.5}$ ; D denotes the difunctional unit  $(\text{CH}_3)_2\text{SiO}$ ; T denotes the trifunctional unit  $(\text{CH}_3)\text{SiO}_{1.5}$ ; and Q denotes the quadri- or tetra-functional unit  $\text{SiO}_2$ . Primes of the unit symbols, e.g., M', D', T', and Q' denote substituents other than methyl, and must be specifically defined for each occurrence. Typical alternate substituents include groups such as vinyl, phenyl, amino, hydroxyl, etc. The molar ratios of the various units, either in terms of subscripts to the symbols indicating the total number of each type of unit in the silicone, or an average thereof, or as specifically indicated ratios in combination with molecular weight, complete the description of the silicone material under the MDTQ system. Higher relative molar amounts of T, Q, T' and/or Q' to D, D', M and/or M' in a silicone resin is indicative of higher levels of crosslinking. As discussed before, however, the overall level of crosslinking can also be indicated by the oxygen to silicon ratio.

The silicone resins for use herein which are preferred are MQ, MT, MTQ, MQ and MDTQ resins. Thus, the preferred silicone substituent is methyl. Especially preferred are MQ resins wherein the M:Q ratio is from about 0.5:1.0 to about 1.5:1.0.

Other silicone fluids, gums, and resins can be found in Encyclopedia of Polymer Science and Engineering, Volume 15, Second Edition, pp 204-308, John Wiley & Sons, Inc., 1989, which is incorporated herein by reference in its entirety.

#### Anionic Surfactant

The anionic surfactant useful for making the silicone emulsion of the present invention are those which act as an acid catalyst for polymerizing the starting silicone material, and are compatible with the remainder of components. Exemplary anionic surfactants are alkyl sulfonic acids, aryl sulfonic acids, or alkyl aryl sulfonic acids where the alkyl group ranges from one to twenty carbon atoms and the aryl group ranges from six to thirty atoms. Highly preferable anionic surfactants are those selected from the group consisting of benzene sulfonic

acid, xylene sulfonic acid, dodecylbenzene sulfonic acid, and twelve to eighteen carbon atom alkyl group sulfonic acids, and mixtures thereof.

#### Compatibilizing Surfactant

The compatibilizing surfactant useful for making the silicone emulsion of the present invention are those which function to compatibilize the anionically emulsion polymerized silicone emulsion with the cationic surfactant. Without being bound by theory, it is believed that, if cationic surfactant is directly added to the anionic mixture obtained after the initial emulsion polymerization of starting silicone material with anionic surfactants, the anionic surfactants included in the anionically emulsion polymerized silicone emulsion having opposing ion charges to the cationic surfactants react to destroy the emulsion and/or produce undesirable precipitation. Thus, the anionically emulsion polymerized silicone emulsion obtained is treated with a compatibilizing surfactant. Useful compatibilizing surfactants are those having an HLB ratio greater than 9. Particularly useful compatibilizing surfactants are ethoxylated fatty acid esters such as polyglycerin fatty acid esters, polyoxyethylene sorbitan fatty acid esters, polyoxyethylene castor oils, polyoxyethylene secondary alkyl ethers where the alkyl group ranges from 6 to 40 carbon atoms, polyoxyethylene alkyl ethers where the alkyl group ranges from 6 to 40 carbon atoms, polyoxyethylene alkyl amines where the alkyl groups range from 6 to 40 carbon atoms and may be independently selected, polyoxyethylene alkyl amides where the alkyl groups range from 6 to 40 carbon atoms and the alkyl groups may be independently selected, amphoteric betaine surfactants, and polyoxyethylene lanolins. A particularly preferred group of surfactants are POE(4) lauryl ether, POE(9) lauryl ether, POE(23) lauryl ether, POE(20) stearyl ether, and POE(20) sorbitan mono-palmitate. Another preferred group of surfactants which may be used to compatibilize the anionic emulsion with cationic surfactants is the group consisting of lauryldimethylaminoacetic acid betaine, coco fatty amide propyldimethylaminoacetic acid betaine, 2-alkyl-N-carboxymethyl-N-hydroxyethylimidazolinium betaine, sodium N-lauroyl sarcosine, and lanolin derivatives of quaternary ammonium salts.

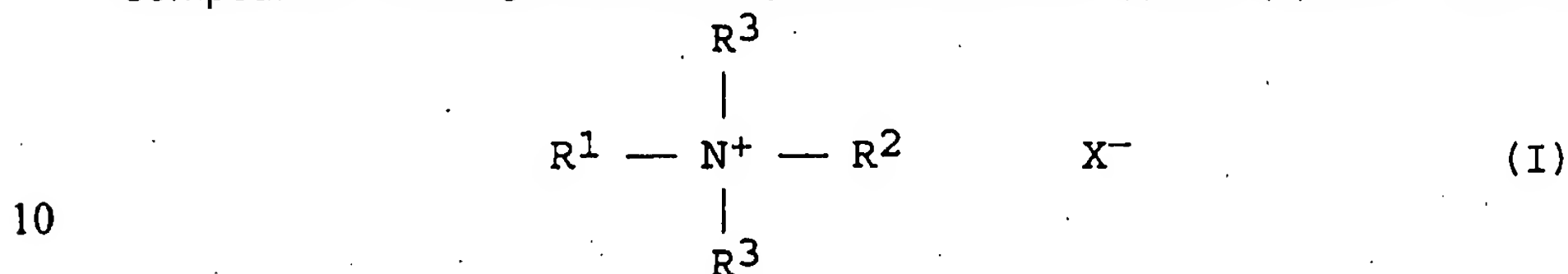
#### Cationic Surfactant

Having treated the anionically emulsion polymerized silicone emulsion with a compatibilizing surfactant, the emulsion can be treated with a cationic surfactant to obtain the cationic surfactant containing silicone emulsion of the present



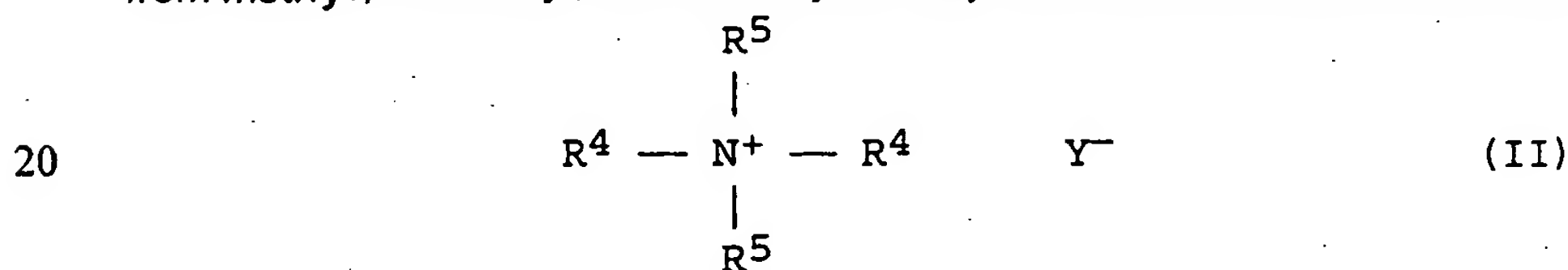
invention. Such silicone emulsions are compatible with a wide range of solvents and propellants, as well as other components of the mousse composition of the present invention. The cationic surfactants useful for making the silicone emulsion of the present invention are any known to the artisan.

5 Cationic surfactants useful in the present invention are quaternary ammonium compounds having the following general formula (I) and (II) and mixtures thereof:



wherein  $R^1$  is alkyl, alkenyl, aryl, alkylamidopropyl, or hydroxyalkyl radical of from about 8 to about 22 carbon atoms, and  $R^2$  is methyl, ethyl, propyl, butyl, benzyl, or up to about 5 ethylene oxide moieties,  $R^3$  is independently methyl, ethyl, or propyl, and X is chloride, bromide, tosylate, or methosulfate. Preferably  $R^1$  is an alkyl, or alkylamidopropyl of from about 16 to about 20,  $R^2$  is selected from methyl, or benzyl,  $R^3$  is methyl or ethyl, and X is chloride or bromide.

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wherein  $R^4$  is alkyl, alkenyl, aryl, alkylamidopropyl, or hydroxyalkyl radical of from about 8 to about 22 carbon atoms,  $R^5$  is independently methyl or ethyl, and Y is chloride, bromide, tosylate, or methosulfate. Preferably  $R^4$  is an alkyl, or hydroxyalkyl,  $R^5$  is methyl or ethyl, and Y is chloride or bromide.

25

Examples of quaternary ammonium cationic surfactants useful for making the silicone emulsion having general formula (I) include alkyltrimonium salts, alkylamidopropyl salts, alkylbenzylammonium salts, and PEG-n alkyl ammonium chlorides (where n is the PEG chain length). Examples of quaternary ammonium cationic surfactants particularly useful herein are:

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(i) alkyltrimonium salts such as Behentrimonium chloride under the trade name of INCROQUAT TMC-80 (Croda), Cetrimonium chloride under the trade name of ARQUAD 16-25W (Akzo), Cetrimonium bromide, Cocotrimonium chloride under the trade name of ARQUAD C-33W (Akzo), Steartrimonium chloride under the trade name of VARISOFT TSC (Sherex), Myrtrimonium bromide, Soytrimonium chloride, Stearyltrimonium methosulfate, Tallowtrimonium chloride under the

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trade name of ADOGEN 471 (Sherex), Cetrimonium tosylate, Laurtrimonium chloride, Dodecylbenzyltrimonium chloride, Cetethyldimonium bromide under the trade name of BRETOL (Hexcel), and Benzyltriethylammonium chloride under the trade name of SUMQUAT 2355 (Hexcel).

- 5 (ii) alkylamidopropyl salts such as Stearamidopropyl trimonium methosulfate under the trade name of CATIGENE SA-70, Stearamidalkonium chloride, Ricinoleamidopropyl Ethyldimonium Chloride under the trade name of SURFACTOL Q1 (CasChem), Stearamidopropalkonium chloride, Quaternium-22, Quaternium-26, Quaternium-33 under the trade name of LANOQUAT 1756  
10 (Henkel).
- (iii) alkylbenzylammonium salts such as Cetalkonium chloride under the trade name of SUMQUAT 6050 (Hexcel), Cetearalkonium bromide, Stearalkonium chloride under the trade name of INCROQUAT SDQ-25 (Croda), and Lauralkonium bromide.
- 15 (iv) PEG-n alkyl ammonium chlorides such as PEG-2 Stearmonium chloride under the trade name of ETHOQUAD 18/12 (Akzo), and PEG-5 Stearmonium chloride.

Examples of quaternary ammonium cationic surfactants useful for making the silicone emulsion having general formula (II) are dialkyldimonium chlorides.

- 20 Preferred compounds include dicetyldimonium chloride under the trade name of ADOGEN 432-100 (Sherex), dicocodimonium chloride under the trade name of VARISOFT 462 (Sherex), distearyldimonium chloride under the trade name of ARQUAD 218-100-P (Akzo), ditallowdimonium chloride and dilauryldimonium chloride.

## 25 STYLING POLYMER

- The hair mousse composition of the present invention comprises a styling polymer for providing styling benefits. Hair polymers suitable for use herein include any polymer soluble or colloiddally dispersible in the aqueous phase. If water is the only solvent in the aqueous phase, the polymer should be soluble or  
30 dispersible in water; if an optional cosolvent such as ethanol is present, the polymer should be soluble or dispersible in the combined solvent system. Solubility/dispersibility is determined at ambient conditions of temperature and pressure (25°C at 1At). Polymers for use in the compositions of the present invention include cationic, anionic, nonionic, and amphoteric resins. Preferably,



at least one cationic polymer is comprised, more preferably the styling polymer is a cationic polymer.

Non-limiting examples of cationic polymers useful in the present invention include quaternized cellulose ethers such as Polyquaternium 10 (hydroxyethylcellulose hydroxypropyl trimethylammonium chloride ether) under the trade name Ucare Polymer LR and Polyquaternium 4 (hydroxyethylcellulose dimethyldiallyl ammonium chloride copolymer) under the trade name Celquat, quaternized vinyl pyrrolidone/ alkylaminoacrylate or methacrylate copolymers such as Polyquaternium 11 (polyvinylpyrrolidone N,N'-dimethylaminoethylmethacrylic acid copolymer diethyl sulfate salt) under the trade name Gafquat, methylvinylimidazolium vinylpyrrolidone quaternary ammonium copolymers commercially available under the trade name Luviquat, vinylmethyl ether ethyl maleate copolymer (PVM/MA copolymer), PVP/VA copolymer under the trade name Luviskol, polyvinyl alcohol, copolymers of polyvinylalcohol and crotonic acid, copolymers of polyvinylalcohol and maleic anhydride, hydroxypropyl cellulose, hydroxypropyl guar gum, sodium polystyrene sulfonate, polyvinylpyrrolidone ethylmethacrylate methacrylic acid terpolymer, octylacrylamide acrylate butylaminoethyl methacrylate copolymers, N-methacryloyl ethyl-N,N'-dimethyl ammonium gamma-N-methyl carboxy betaine butyl methacrylate copolymer under the trade name Yukaformer AM-75, and mixtures thereof.

Other examples of cationic polymers include silicone-grafted copolymers (including mixtures of such copolymers), comprising silicone covalently bonded to the polymer backbone (i.e. silicone chains are grafted to the backbone), and are derived by polymerization of a combination of nonionic, nonquaternizable, water soluble monomers and nonionic, quaternizable monomers. The silicone macromers will generally be incorporated into the polymer by conducting the polymerization of the above two types of monomers also in the presence of silicone macromer, i.e. silicone containing monomers.

The silicone macromer-grafted copolymers hereof will have a polymeric backbone with a Tg of from about 30°C to about 140°C. The silicone macromer-containing copolymers have an organic polymeric backbone, preferably a vinyl backbone or other carbon-based backbone derived from ethylenically unsaturated polymerizable monomers. The polymers are derived by polymerization of: from about 2% to 15%, by weight, of silicone macromers; from

about 5% to 40%, by weight, anionic, quaternizable monomers; and from about 30% to 60%, by weight, of non-ionic, water soluble, nonquaternizable monomers. At least 5% of the monomers, by weight are quaternized.

The quaternizable nonionic monomers hereof include quaternizable, amino-  
5 functional ethylenically unsaturated monomers, such as the amino functional derivatives of styrene, acrylamides, methacrylamides, (meth)acrylates such as C<sub>1</sub>-C<sub>5</sub> alkyl esters of acrylic acid and methacrylic acid.

Examples of such monomers include: (i) p-dimethylaminomethylstyrene, p-dimethylaminoethylstyrene; (ii) dimethylaminomethyl acrylamide,  
10 dimethylaminopropyl acrylamide, dimethylaminopropyl methacrylamide, dimethylaminomethyl methacrylamide, dimethylaminoethyl (meth)acrylate, diethylaminoethyl (meth)acrylate, dimethylaminopropyl (meth)acrylate, and dimethylaminopropyl (meth)acrylamide.

Examples of nonionic, nonquaternizable, water soluble monomers include  
15 acrylamides, methacrylamides, (meth)acrylates, cinamides, vinyl alcohols, vinyl pyrrolidones, vinyl oxazolidones, and derivatives thereof. Specific examples include acrylamide, methacrylamide, mono- and di- C<sub>1</sub>-C<sub>6</sub> alkyl (meth)acrylamides, such as dimethylacrylamide, dimethylmethacrylamide, isopropylacrylamide, t-butylacrylamide, isopropylmethacrylamide, diacetone  
20 acrylamide, mono- and di- C<sub>1</sub>-C<sub>20</sub> alkyl (meth) acrylamides, such dimethylacrylate, t-butyl acrylate, t-butyl methacrylate, isopropyl methacrylate, stearyl methacrylate, cetyl methacrylate, acrylglycinamide, methacrylglycinamide, vinyl alcohol, vinyl pyrrolidone, vinyl oxazolidone, vinylmethoxazolidone, and poly(ethylene glycol) phenyl ether (meth)acrylate.

25 Other examples of cationic polymers are cationic guar gums, for example, hydroxypropyltrimethylammonium guar gum, quaternized cellulose ethers such as copolymers of hydroxyethylcellulose with diallyldimethyl ammonium chloride or with trimethyl ammonium substituted epoxides, homopolymers of lower alkylamino alkyl acrylate or methacrylate monomers (e.g. dimethyl  
30 aminoethylmethacrylate) and copolymers thereof with compatible monomers such as N-vinylpyrrolidone or with methacrylate derivatives such as methyl, ethyl and oleyl methacrylates and mixtures thereof and/or with alkyl acrylates such as methyl and butyl acrylates and mixtures thereof, copolymers of dimethyldiallyl ammonium chloride and acrylamide, homopolymers of dimethyldiallyl ammonium  
35 chloride, vinylimidazolium/vinyl pyrrolidone copolymers, and mixtures thereof.

Other examples of polycationic hair conditioning polymers can be derived from polymerizable cationic starting monomers, or from polymerizable nonionic monomers which are modified subsequent to polymerization to be of cationic character.

5        Examples of the cationic monomers include:

monomers derived from acrylic acid or methacrylic acid, which is referred to hereinafter collectively as (meth)acrylic acid, and a quaternized epihalohydrin product of a trialkyl amine having 1 to 5 carbon atoms in the alkyl group such as (meth)acryloxypropyltrimethylammonium chloride and (meth)acryloxy propyltriethylammonium bromide;

10        amine derivatives of (meth)acrylic acid or amine derivatives of (meth)acrylamide derived from (meth)acrylic acid or (meth)acrylamide and a dialkylalkanolamine have C<sub>1</sub>-C<sub>4</sub> alkyl groups such as dimethylaminoethyl (meth)acrylate, diethylaminoethyl (meth)acrylate, dimethylaminopropyl (meth)acrylate, or dimethylaminopropyl (meth)acrylamide; and

15        derivatives of the products of the group (ii) above by (1) neutralization with an inorganic or organic acid, such as hydrochloric acid, or lactic acid, (2) modification with a halogenated alkyl, such as methyl chloride, ethyl chloride, methyl bromide, or ethyl iodide, (3) modification with a halogenated fatty acid ester such as ethyl monochloroacetate, or methyl monochloropropionate, and (4)

20        modification with a dialkyl sulfate such as dimethyl sulfate, or diethyl sulfate.

Furthermore, the cationic unsaturated monomers include amine derivatives of allyl compounds such as diallyldimethylammonium chloride and the like as well as vinylimidazolium quaternary ammonium monomers.

25        These cationic unsaturated monomers can be polymerized in cationic form, or as an alternative they can be polymerized in the form of their precursors, which are then modified to be cationic, for example, by a quaternizing agent (eg. ethyl monochloroacetate, dimethyl sulfate, diethyl sulfate, methyl chloride, etc.)

Non-limiting examples of nonionic monomers are acrylic or methacrylic acid esters of C<sub>1</sub>-C<sub>24</sub> alcohols, such as methanol, ethanol, 1-propanol, 2-propanol, 1-butanol, 2-methyl-1-propanol, 1-pentanol, 2-pentanol, 3-pentanol, 2-methyl-1-butanol, 1-methyl-1-butanol, 3-methyl-1-butanol, 1-methyl-1-pentanol, 2-methyl-1-pentanol, 3-methyl-1-pentanol, t-butanol, cyclohexanol, 2-ethyl-1-butanol, 3-heptanol, benzyl alcohol, 2-octanol, 6-methyl-1-heptanol, 2-ethyl-1-hexanol, 3,5-

35        dimethyl-1-hexanol, 3,5,5-trimethyl-1-hexanol, 1-decanol, 1-dodecanol, 1-

hexadecanol, 1-octadecanol, and the like, the alcohols having from about 1-24 carbon atoms; styrene; chlorostyrene; vinyl esters such as vinyl acetate; vinyl chloride; vinylidene chloride; acrylonitrile; alpha-methylstyrene; t-butylstyrene; butadiene; cyclohexadiene; ethylene; propylene; vinyl toluene; alkoxyalkyl (meth)acrylate, such as methoxy ethyl (meth)acrylate and butoxyethyl (meth)acrylate; and mixtures thereof. Other nonionic monomers include acrylate and methacrylate derivatives such as allyl acrylate and methacrylate, cyclohexyl acrylate and methacrylate, oleyl acrylate and methacrylate, benzyl acrylate and methacrylate, tetrahydrofurfuryl acrylate and methacrylate, ethylene glycol diacrylate and -methacrylate, 1,3-buteneglycol d-acrylate and -methacrylate, diacetone acrylamide, isobornyl (meth)acrylate, and the like.

Non-limiting examples of polar nonionic monomers include acrylamide, N,N-dimethylacrylamide, methacrylamide, N-t-butyl acrylamide, methacrylonitrile, acrylamide, acrylate alcohols (eg. C<sub>2</sub>-C<sub>6</sub> acrylate alcohols such as hydroxyethyl acrylate, hydroxypropyl acrylate), hydroxyethyl methacrylate, hydroxypropyl methacrylate, vinyl pyrrolidone, vinyl ethers, such as methyl vinyl ether, acyl lactones and vinyl pyridine, allyl alcohols, vinyl alcohols and vinyl caprolactam.

Non-limiting examples of polycationic polymers include cationic polysaccharides, homopolymers of dimethyldiallyl ammonium chloride, copolymers of dimethyldiallyl ammonium chloride and acrylamide, cationic amino-functional homopolymers and copolymers derived from acrylic acid and/or methacrylic acid, especially from alkylaminoalkyl acrylate and methacrylate monomers such as dimethylaminoethyl acrylate and methacrylate, polyalkylene imines and ethoxy polyalkylene imines, vinylimidazolium/vinylpyrrolidone quaternary ammonium copolymers, and mixtures thereof.

The styling polymers herein which include anionic monomers are preferably utilised in at least partially neutralised form in order to aid shampoo removability of the liquid hair cosmetic compositions. In the compositions according to the present invention the neutralisation of a polymer may be achieved by use of an inorganic base, preferably KOH. However organic base, preferably AMP (amino methyl propanol) and mixture of inorganic and organic base may also be used to effect the desired level of neutralisation in hair mousse compositions according to the present invention. In total from about 30% to about 95%, preferably from about 55% to about 80%, most preferably from about 60% to about 70% of the acidic monomers of each polymer utilised should be neutralised with base.

Any conventionally used base, organic or inorganic, may be used for neutralisation of acidic polymers providing they are utilised as specified herein. Hydroxides of alkali, alkaline earth and amino alcohols are suitable neutralisers for use in the present invention.

5        Examples of suitable organic neutralising agents which may be included in the compositions of the present invention include amines, especially amino alcohols such as 2-amino-2-methyl-1, 3-propanediol (AMPD), 2-amino-2-ethyl-1, 3-propanediol (AEPD), 2-amino-2-methyl-1-propanol (AMP), 2-amino-1-butanol (AB), monoethanolamine (MEA), diethanolamine (DEA), triethanolamine (TEA),  
10        monoisopropanolamine (MIPA), diisopropanolamine (DIPA), triisopropanolamine (TIPA), dimethyl steramine (DMS) and amino methyl propanol (AMP) and mixtures thereof.

Preferred neutralising agents for use in hair mousse compositions of the present invention are potassium and sodium hydroxides.

15        The styling polymer is typically included at a level by weight of from about 0.5% to about 15%, preferably from about 0.5% to about 10% of the concentrate. The level and species are selected according to the desired characteristic of the product.

#### ADDITIONAL SURFACTANTS

20        Hair mousse compositions of the present invention further comprise additional surfactants. Such additional surfactants comprise anionic surfactants, amphoteric surfactants, zwitterionic surfactants, nonionic surfactants, cationic surfactants, and mixtures thereof which do not affect the mousse composition of the present invention. These may or may not be the same surfactants  
25        comprised in the silicone emulsion as mentioned above. Cationic surfactants useful herein are the same as those useful for making the silicone emulsion as described above.

The additional surfactant is typically included at a level by weight of from about 0.1% to about 15%, preferably from about 0.3% to about 10% of the  
30        concentrate. The level and species are selected according to the compatibility with the styling polymer, and desired characteristic of the product.

#### Anionic Surfactants

Suitable anionic surfactants are the reaction products of fatty acids esterified with isethionic acid and neutralized with sodium hydroxide where, for  
35        example, the fatty acids are derived from coconut or palm oil; or sodium or

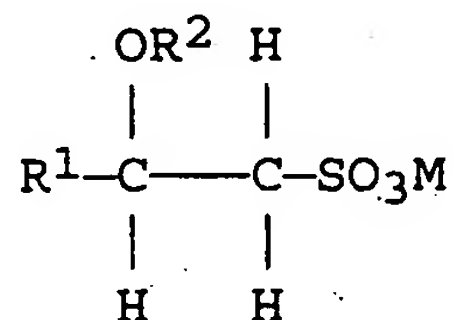


potassium salts of fatty acid amides of methyl tauride in which the fatty acids, for example, are derived from coconut oil. Other similar anionic surfactants are described in U.S. Patents 2,486,921, 2,486,922, and 2,396,278, which are incorporated by reference herein in their entirety.

5 Other anionic surfactants suitable herein are the succinates, examples of which include disodium N-octadecylsulfosuccinate; disodium lauryl sulfosuccinate; diammonium lauryl sulfosuccinate; tetra sodium N-(1,2-dicarboxyethyl)-N-octadecyl- sulfosuccinate; the diamyl ester of sodium sulfosuccinic acid; the dihexyl ester of sodium sulfosuccinic acid; and the dioctyl  
10 ester of sodium sulfosuccinic acid.

Other anionic surfactants suitable herein are those that are derived from amino acids. Nonlimiting examples of such surfactants include N-acyl-L-glutamate, N-acyl-N-methyl-alanate, N-acylsarcosinate, and their salts.

15 Another class of anionic surfactants suitable for use in the present invention are the betaalkyloxy alkane sulfonates. These compounds have the following formula:



20 where R<sup>1</sup> is a straight chain alkyl group having from about 6 to about 20 carbon atoms, R<sup>2</sup> is a lower alkyl group having from about 1, preferred, to about 3 carbon atoms, and M is as hereinbefore described. Many other anionic  
25 surfactants suitable for use are described in McCutcheon's, Emulsifiers and Detergents, 1989 Annual, published by M. C. Publishing Co., and in U.S. Patent 3,929,678, which descriptions are incorporated herein by reference in their entirety. Preferred anionic surfactants for use include ammonium lauryl sulfate, ammonium laureth sulfate, triethylamine lauryl sulfate, triethylamine laureth  
30 sulfate, triethanolamine lauryl sulfate, triethanolamine laureth sulfate, monoethanolamine lauryl sulfate, monoethanolamine laureth sulfate, diethanolamine lauryl sulfate, diethanolamine laureth sulfate, lauric monoglyceride sodium sulfate, sodium lauryl sulfate, sodium laureth sulfate, potassium lauryl sulfate, potassium laureth sulfate, sodium lauryl sarcosinate, sodium lauroyl sarcosinate, lauryl sarcosine, cocoyl sarcosine, ammonium cocoyl  
35 sulfate, ammonium lauroyl sulfate, sodium cocoyl sulfate, sodium lauroyl sulfate,

potassium cocoyl sulfate, potassium lauryl sulfate, triethanolamine lauryl sulfate, triethanolamine lauryl sulfate, monoethanolamine cocoyl sulfate, monoethanolamine lauryl sulfate, sodium tridecyl benzene sulfonate, and sodium dodecyl benzene sulfonate, sodium N-lauroyl-L-glutamate, triethanolamine, N-lauryoyl-L-glutamate, sodium N-lauroyl-N-methyl taurate, sodium N-lauroyl-N-methyl-aminopropionate, and mixtures thereof.

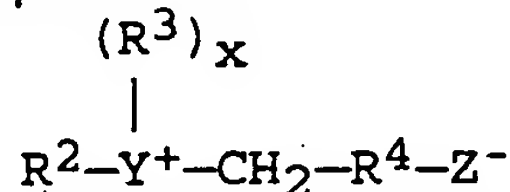
#### Amphoteric and Zwitterionic Surfactants

The compositions of the present invention can comprise amphoteric and/or zwitterionic surfactants.

Amphoteric surfactants for use herein include the derivatives of aliphatic secondary and tertiary amines in which the aliphatic radical is straight or branched and one of the aliphatic substituents contains from about 8 to about 18 carbon atoms and one contains an anionic water solubilizing group, e.g., carboxy, sulfonate, sulfate, phosphate, or phosphonate.

Zwitterionic surfactants for use herein include the derivatives of aliphatic quaternary ammonium, phosphonium, and sulfonium compounds, in which the aliphatic radicals are straight or branched, and wherein one of the aliphatic substituents contains from about 8 to about 18 carbon atoms and one contains an anionic group, e.g., carboxy, sulfonate, sulfate, phosphate, or phosphonate.

A general formula for these compounds is:



where R<sup>2</sup> contains an alkyl, alkenyl, or hydroxy alkyl radical of from about 8 to about 18 carbon atoms, from 0 to about 10 ethylene oxide moieties and from 0 to about 1 glyceryl moiety; Y is selected from the group consisting of nitrogen, phosphorus, and sulfur atoms; R<sup>3</sup> is an alkyl or monohydroxyalkyl group containing 1 to about 3 carbon atoms; X is 1 when Y is a sulfur atom, and 2 when Y is a nitrogen or phosphorus atom; R<sup>4</sup> is an alkylene or hydroxyalkylene of from 1 to about 4 carbon atoms and Z is a radical selected from the group consisting of carboxylate, sulfonate, sulfate, phosphonate, and phosphate groups.

Examples of amphoteric and zwitterionic surfactants also include sultaines and amidosultaines. Sultaines, including amidosultaines, include for example, cocodimethylpropylsultaine, stearyldimethylpropylsultaine, lauryl-bis-(2-hydroxyethyl) propylsultaine and the like; and the amidosultaines such as

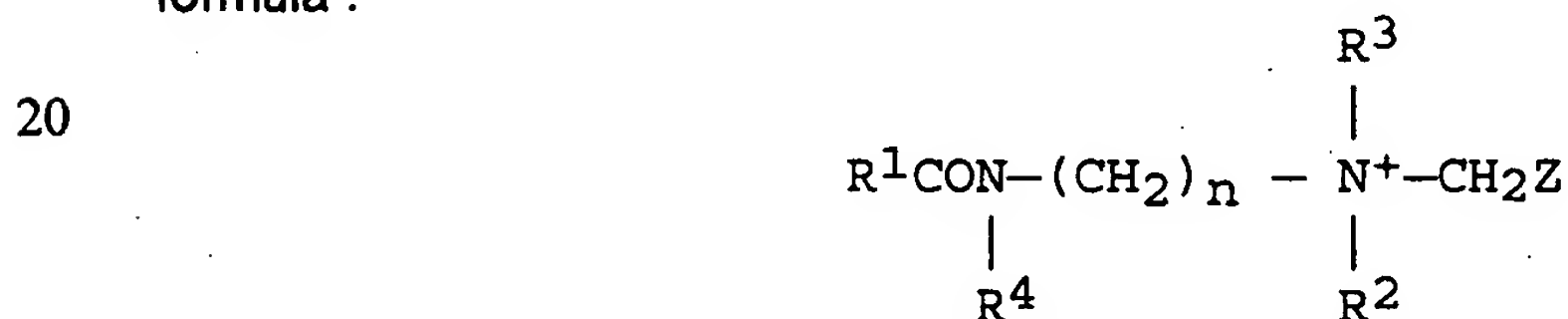


cocamidodimethylpropylsultaine, stearylamidododimethylpropylsultaine, laurylamidobis-(2-hydroxyethyl) propylsultaine, and the like. Preferred are amidohydroxysultaines such as the C<sub>12</sub>-C<sub>18</sub> hydrocarbyl amidopropyl hydroxysultaines, especially C<sub>12</sub>-C<sub>14</sub> hydrocarbyl amido propyl hydroxysultaines, e.g., laurylamidopropyl hydroxysultaine and cocamidopropyl hydroxysultaine. Other sultaines are described in U.S. Patent 3,950,417, which is incorporated herein by reference in its entirety.

Other suitable amphoteric surfactants are the aminoalkanoates of the formula R-NH(CH<sub>2</sub>)<sub>n</sub>COOM, the iminodialkanoates of the formula R-N[(CH<sub>2</sub>)<sub>m</sub>COOM]<sub>2</sub> and mixtures thereof; wherein n and m are numbers from 1 to about 4, R is C<sub>8</sub> - C<sub>22</sub> alkyl or alkenyl, and M is hydrogen, alkali metal, alkaline earth metal, ammonium or alkanolammonium.

Examples of suitable aminoalkanoates include n-alkylamino-propionates and n-alkyliminodipropionates, specific examples of which include N-lauryl-beta-amino propionic acid or salts thereof, and N-lauryl-beta-imino-dipropionic acid or salts thereof, and mixtures thereof.

Other suitable amphoteric surfactants include those represented by the formula :



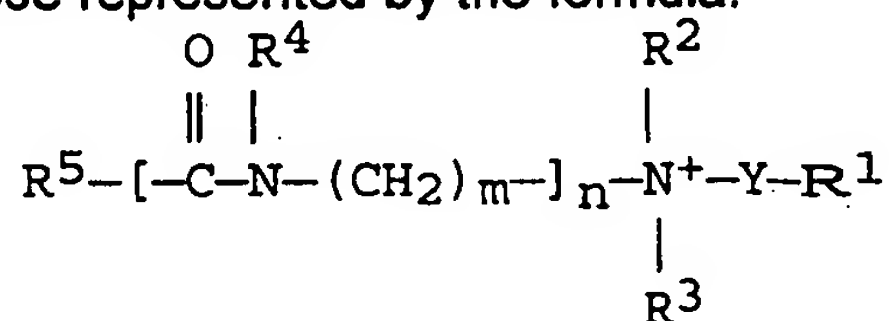
wherein R<sup>1</sup> is C<sub>8</sub> - C<sub>22</sub> alkyl or alkenyl, preferably C<sub>12</sub>-C<sub>16</sub>, R<sup>2</sup> and R<sup>3</sup> is independently selected from the group consisting of hydrogen, CH<sub>2</sub>CO<sub>2</sub>M, CH<sub>2</sub>CH<sub>2</sub>OH, CH<sub>2</sub>CH<sub>2</sub>OCH<sub>2</sub>CH<sub>2</sub>COOM, or (CH<sub>2</sub>CH<sub>2</sub>O)<sub>m</sub>H wherein m is an integer from 1 to about 25, and R<sup>4</sup> is hydrogen, CH<sub>2</sub>CH<sub>2</sub>OH, or CH<sub>2</sub>CH<sub>2</sub>OCH<sub>2</sub>CH<sub>2</sub>COOM, Z is CO<sub>2</sub>M or CH<sub>2</sub>CO<sub>2</sub>M, n is 2 or 3, preferably 2, M is hydrogen or a cation, such as alkali metal (e.g., lithium, sodium, potassium), alkaline earth metal (beryllium, magnesium, calcium, strontium, barium), or ammonium. This type of surfactant is sometimes classified as an imidazoline-type amphoteric surfactant, although it should be recognized that it does not necessarily have to be derived, directly or indirectly, through an imidazoline intermediate. Suitable materials of this type are marketed under the tradename MIRANOL and are understood to comprise a complex mixture of species, and can exist in protonated and non-protonated species depending upon pH with

respect to species that can have a hydrogen at R<sup>2</sup>. All such variations and species are meant to be encompassed by the above formula.

Examples of surfactants of the above formula are monocarboxylates and dicarboxylates. Examples of these materials include  
 5 cocoamphocarboxypropionate, cocoamphocarboxypropionic acid, cocoamphocarboxyglycinate (alternately referred to as cocoamphodiacetate), and cocoamphoacetate.

Commercial amphoteric surfactants include those sold under the trade names MIRANOL C2M CONC. N.P., MIRANOL C2M CONC. O.P., MIRANOL  
 10 C2M SF, MIRANOL CM SPECIAL (Miranol, Inc.); ALKATERIC 2CIB (Alkaril Chemicals); AMPHOTERGE W-2 (Lonza, Inc.); MONATERIC CDX-38, MONATERIC CSH-32 (Mona Industries); REWOTERIC AM-2C (Rewo Chemical Group); and SCHERCOTERIC MS-2 (Scher Chemicals).

Betaine surfactants, i.e. zwitterionic surfactants, suitable for use in the  
 15 present compositions are those represented by the formula:



wherein: R<sup>1</sup> is a member selected from the group consisting of  
 COOM and CHCH<sub>2</sub>SO<sub>3</sub>M



25 R<sup>2</sup> is lower alkyl or hydroxyalkyl; R<sup>3</sup> is lower alkyl or hydroxyalkyl; R<sup>4</sup> is a member selected from the group consisting of hydrogen and lower alkyl; R<sup>5</sup> is higher alkyl or alkenyl; Y is lower alkyl, preferably methyl; m is an integer from 2 to 7, preferably from 2 to 3; n is the integer 1 or 0; M is hydrogen or a cation, as previously described, such as an alkali metal, alkaline earth metal, or  
 30 ammonium. The term "lower alkyl" or "hydroxyalkyl" means straight or branch chained, saturated, aliphatic hydrocarbon radicals and substituted hydrocarbon radicals having from one to about three carbon atoms such as, for example, methyl, ethyl, propyl, isopropyl, hydroxypropyl, hydroxyethyl, and the like. The term "higher alkyl or alkenyl" means straight or branch chained saturated (i.e.,  
 35 "higher alkyl") and unsaturated (i.e., "higher alkenyl") aliphatic hydrocarbon radicals having from about eight to about 20 carbon atoms such as, for example, lauryl, cetyl, stearyl, oleyl, and the like. It should be understood that the term

"higher alkyl or alkenyl" includes mixtures of radicals which may contain one or more intermediate linkages such as ether or polyether linkages or non-functional substituents such as hydroxyl or halogen radicals wherein the radical remains of hydrophobic character.

5           Examples of surfactant betaines of the above formula wherein n is zero  
which are useful herein include the alkylbetaines such as  
cocodimethylcarboxymethylbetaine, lauryldimethylcarboxymethylbetaine, lauryl  
dimethyl- $\alpha$ -carboxyethylbetaine, cetyldimethylcarboxymethylbetaine, lauryl-  
bis-(2-hydroxyethyl)carboxymethylbetaine, stearyl-bis-(2-  
10 hydroxypropyl)carboxymethylbetaine, oleyldimethyl-gamma-  
carboxypropylbetaine, lauryl-bis-(2-hydroxypropyl) $\alpha$ -carboxyethylbetaine,  
etc. The sulfobetaines may be represented by cocodimethylsulfopropylbetaine,  
stearyldimethylsulfopropylbetaine, lauryl-bis-(2-hydroxyethyl)sulfopropylbetaine,  
and the like.

Specific examples of amido betaines and amidosulfo betaines useful in the present compositions include the amidocarboxybetaines, such as cocamidodimethylcarboxymethylbetaine, laurylamidodimethylcarboxymethylbetaine, cetylamidodimethylcarboxymethylbetaine, laurylamido-bis-(2-hydroxyethyl)-carboxymethylbetaine, cocamido-bis-(2-hydroxyethyl)-carboxymethylbetaine, etc. The amido sulfobetaines may be represented by cocamidodimethylsulfopropylbetaine, stearylamidodimethylsulfopropylbetaine, laurylamido-bis-(2-hydroxyethyl)-sulfopropylbetaine, and the like.

## Nonionic Surfactants

25 The compositions of the present invention can comprise a nonionic surfactant. Nonionic surfactants include those compounds produced by condensation of alkylene oxide groups, hydrophilic in nature, with an organic hydrophobic compound, which may be aliphatic or alkyl aromatic in nature.

Preferred nonlimiting examples of nonionic surfactants for use herein  
30 include the following:

(1) polyethylene oxide condensates of alkyl phenols, e.g., the condensation products of alkyl phenols having an alkyl group containing from about 6 to about 20 carbon atoms in either a straight chain or branched chain configuration, with ethylene oxide, the said ethylene oxide being present in

amounts equal to from about 10 to about 60 moles of ethylene oxide per mole of alkyl phenol;

(2) those derived from the condensation of ethylene oxide with the product resulting from the reaction of propylene oxide and ethylene diamine products;

5 (3) condensation products of aliphatic alcohols having from about 8 to about 18 carbon atoms, in either straight chain or branched chain configurations, with ethylene oxide, e.g., a coconut alcohol ethylene oxide condensate having from about 10 to about 30 moles of ethylene oxide per mole of coconut alcohol, the coconut alcohol fraction having from about 10 to about 14 carbon atoms;

10 (4) long chain tertiary amine oxides of the formula  $[R^1R^2R^3N \rightarrow O]$  where  $R^1$  contains an alkyl, alkenyl or monohydroxy alkyl radical of from about 8 to about 18 carbon atoms, from 0 to about 10 ethylene oxide moieties, and from 0 to about 1 glyceryl moiety, and  $R^2$  and  $R^3$  contain from about 1 to about 3 carbon atoms and from 0 to about 1 hydroxy group, e.g., methyl, ethyl, propyl, hydroxyethyl, or hydroxypropyl radicals;

15 (5) long chain tertiary phosphine oxides of the formula  $[RR'R''P \rightarrow O]$  where R contains an alkyl, alkenyl or monohydroxyalkyl radical ranging from about 8 to about 18 carbon atoms in chain length, from 0 to about 10 ethylene oxide moieties and from 0 to 1 glyceryl moieties and  $R'$  and  $R''$  are each alkyl or monohydroxyalkyl groups containing from about 1 to about 3 carbon atoms;

20 (6) long chain dialkyl sulfoxides containing one short chain alkyl or hydroxy alkyl radical of from 1 to about 3 carbon atoms (usually methyl) and one long hydrophobic chain which include alkyl, alkenyl, hydroxy alkyl, or keto alkyl radicals containing from about 8 to about 20 carbon atoms, from 0 to about 10 ethylene oxide moieties and from 0 to 1 glyceryl moieties;

25 (7) alkyl polysaccharide (APS) surfactants (e.g. alkyl polyglycosides), examples of which are described in U.S. Patent 4,565,647, which is incorporated herein by reference in its entirety, and which discloses APS surfactants having a hydrophobic group with about 6 to about 30 carbon atoms and a polysaccharide (e.g., polyglycoside) as the hydrophilic group; optionally, there can be a polyalkylene-oxide group joining the hydrophobic and hydrophilic moieties; and the alkyl group (i.e., the hydrophobic moiety) can be saturated or unsaturated, branched or unbranched, and unsubstituted or substituted (e.g., with hydroxy or cyclic rings); a preferred material is alkyl polyglucoside which is commercially  
35 available from Henkel, ICI Americas, and Seppic; and

(8) polyoxyethylene alkyl ethers such as those of the formula  $RO(CH_2CH_2)_nH$  and polyethylene glycol (PEG) glyceryl fatty esters, such as those of the formula  $R(O)OCH_2CH(OH)CH_2(OCH_2CH_2)_nOH$ , wherein  $n$  is from 1 to about 200, preferably from about 20 to about 100, and  $R$  is an alkyl having  
5 from about 8 to about 22 carbon atoms.

### SOLVENT

Solvents used in the present invention are selected depending on variables such as the remainder of components, viscosity, and desired foaming characteristic of the composition. To retain the stability of the silicone emulsion, the solvent comprises at least about 80% water, more preferably at least about 90% water.

Non-limiting examples of solvents useful in the present invention are: water, lower alcohols having 1 to 6 carbons such as ethanol and isopropanol, and polyhydric alcohols such as propylene glycol, hexylene glycol, glycerin, and propane diol, and mixtures thereof.

The solvent is preferably comprised at a level by weight of from about 60% to about 99%, more preferably from about 80% to about 99%, still preferably from about 85% to about 98% of the concentrate.

### OPTIONAL COMPONENTS

Optional components can be included in the hair mousse compositions of the present invention, depending on the needs of the product. Non-limiting examples of such optional components include conditioning agents, preservatives, perfume, ultraviolet and infrared screening and absorbing agents, colorants, pH adjusters, polymers, dyes, vitamins, proteins, plant extracts, and nutrients.

#### Conditioning agents

Conditioning agents may be comprised in the hair mousse composition of the present invention. Suitable conditioning agents include fatty alcohols, fatty acids, and hydrocarbons.

The fatty alcohols useful herein are those having from about 10 to about 30 carbon atoms, preferably from about 12 to about 22 carbon atoms, and more preferably from about 16 to about 22 carbon atoms. These fatty alcohols can be straight or branched chain alcohols and can be saturated or unsaturated. Nonlimiting examples of fatty alcohols include decyl alcohol, undecyl alcohol, dodecyl, myristyl, cetyl alcohol, stearyl alcohol, isostearyl alcohol, isocetyl alcohol, behenyl alcohol, linalool, oleyl alcohol, cholesterol, cis-4-t-butylcyclohexanol, myricyl alcohol and mixtures thereof. Especially preferred fatty alcohols are those selected from the group consisting of cetyl alcohol, stearyl alcohol, isostearyl alcohol, oleyl alcohol, and mixtures thereof.



The fatty acids useful herein are those having from about 10 to about 30 carbon atoms, preferably from about 12 to about 22 carbon atoms, and more preferably from about 16 to about 22 carbon atoms. These fatty acids can be straight or branched chain acids and can be saturated or unsaturated. Also included are diacids, triacids, and other multiple acids which meet the carbon number requirement herein. Also included herein are salts of these fatty acids. Nonlimiting examples of fatty acids include lauric acid, palmitic acid, stearic acid, behenic acid, arichidonic acid, oleic acid, isostearic acid, sebacic acid, and mixtures thereof. Especially preferred for use herein are the fatty acids selected from the group consisting of palmitic acid, stearic acid, and mixtures thereof.

Hydrocarbons are useful herein as conditioning agents. Useful hydrocarbons include straight chain, cyclic, and branched chain hydrocarbons which can be either saturated or unsaturated. The hydrocarbons preferably will have from about 12 to about 40 carbon atoms, more preferably from about 12 to about 30 carbon atoms, and most preferably from about 12 to about 22 carbon atoms. Also encompassed herein are polymeric hydrocarbons of alkenyl monomers, such as polymers of C<sub>2</sub>-C<sub>6</sub> alkenyl monomers. These polymers can be straight or branched chain polymers. The straight chain polymers will typically be relatively short in length, having a total number of carbon atoms as described above in this paragraph. The branched chain polymers can have substantially higher chain lengths. The number average molecular weight of such materials can vary widely, but will typically be up to about 500, preferably from about 200 to about 400, and more preferably from about 300 to about 350. Also useful herein are the various grades of mineral oils. Mineral oils are liquid mixtures of hydrocarbons that are obtained from petroleum. Specific examples of suitable hydrocarbon materials include paraffin oil, mineral oil, dodecane, isododecane, hexadecane, isohexadecane, eicosene, isoeicosene, tridecane, tetradecane, polybutene, polyisobutene, and mixtures thereof. Isododecane, isohexadecane, and isoeicosene are commercially available as Permethyl 99A, Permethyl 101A, and Permethyl 1082, from Presperse, South Plainfield, NJ. A copolymer of isobutene and normal butene is commercially available as Indopol H-100 from Amoco Chemicals. Preferred for use herein are hydrocarbon conditioning agents selected from the group consisting of mineral oil, isododecane, isohexadecane, polybutene, polyisobutene, and mixtures thereof.



When included, these conditioning agents are comprised at a level by weight of from about 0.01% to about 2% of the concentrate.

#### Preservative

Hair mousse compositions of the present invention can further comprise a preservative. Such preservative is preferably included at a level by weight of up to about 5%, more preferably up to about 3% of the concentrate.

Non-limiting examples of preservatives useful in the present invention are DMDM Hydantoin (dimethylol dimethyl hydantoin) Kathon CG, (mixture of methylchloro-isothiazolinone and methyl isothiazolinone), imidazolidinyl urea, phenoxyethanol, EDTA and its salts, benzyl alcohol, and parabens such as methyl paraben, propyl paraben, butyl paraben, and LiquaPar oil (mixture of isobutyl paraben, isopropyl paraben, and butyl paraben).

#### Propellant

Propellants when used in the present invention are selected depending on variables such as the remainder of components, the package, and how the product is designed to be used (standing or invert).

When comprised in hair mousses, the propellant is preferably comprised at a level of up to about 60%, more preferably up to about 30% of the entire composition. When no propellant is used, the hair mousse composition is usually provided in a package equipped with an air or gas mixing device.

Non-limiting examples of propellants useful in the present invention are: fluorohydrocarbons such as difluoroethane 152a (supplied by DuPont), dimethyl ether, and hydrocarbons such as propane, iso-butane, n-butane, and mixtures of hydrocarbons such as LPG (liquefied petroleum gas).

#### Other Optional Components

Hair mousse compositions of the present invention may further comprise a variety of optional components. Such optional components include; thickeners and viscosity modifiers such as diethanolamides of long chain fatty acids, sodium chloride, and sodium sulfate, ultraviolet absorbing agents such as octyl salicylate, pH adjusting agents such as citric acid, succinic acid, sodium hydroxide and triethanolamine, coloring agents, hair oxidizing agents such as hydrogen peroxide, perborate salts and persulfate salts, hair reducing agents such as thioglycolates, perfumes, perfume solubilizing agents such as polyethylene glycol fatty acid esters, sequestering agents, polymer plasticizing agents such as glycerin and propylene glycol, and volatile and non-volatile

silicone fluids of low molecular weight. Such optional ingredients are typically included at a level by weight of 0.01% to 20%, preferably from 0.1 to 10% of the concentrate.

### EXAMPLES

The following examples further describe and demonstrate embodiments within the scope of the present invention. The examples are given solely for the purpose of illustration and are not to be construed as limitations of the present invention, as many variations thereof are possible without departing from the spirit and scope of the invention. Ingredients are identified by chemical or CTFA name, or otherwise defined below.

Examples I through IV specified below can be prepared by any conventional method well known in the art. A suitable method is as follows: The styling polymer, neutralizers, additional surfactants, conditioning agents, and preservatives are added into distilled water under agitation at 70-75°C. Other ingredients except for silicone emulsion and perfume are added to the above and agitated. The obtained mixture is allowed to cool, and the silicone emulsion and perfume is added. The obtained concentrate is packed into aerosol cans with L. P. G. propellant so that the final compositions for Examples I through IV include 94.0% concentrate and 6.0% propellant.

COMPONENTS IN CONCENTRATE		AMOUNT (%)			
EXAMPLE NO.		I	II	III	IV
20	Silicone Emulsion *1	0.50	0.50	1.0	0.50
	Celquat L-200 *2	3.00	—	—	—
	Polymer 1 *3	—	4.00	4.00	—
	Polymer 2 *4	—	—	—	4.00
	Aminomethylpropanol	—	0.21	0.21	0.21
25	NaOH	—	0.55	0.55	0.55
	Laureth 4	0.26	0.26	0.26	0.20
	Laureth 21	0.32	0.32	0.32	0.25
	Mineral Oil	—	—	—	0.05
	Cetyl alcohol	—	—	—	0.10
30	Propyleneglycol	0.05	0.05	0.05	0.05
	Methyl Paraben	0.15	0.15	0.15	0.15
	Phenoxyethanol	0.25	0.25	0.25	0.25
	Disodium EDTA	0.10	0.10	0.10	0.10
	Perfume	0.10	0.10	0.05	0.10
35	DI Water	q.s.	q.s.	q.s.	q.s.

Total of Concentrate

100 100 100 100

\*1 Silicone Emulsion: An emulsion of the following formula:

	33%	dimethiconol
	5.4%	cyclomethicone
	0.8%	sodium dodecylbenzene sulfonate
5	1.6%	POE(18) nonyl phenyl ether
	0.8%	cetyltrimethyl ammonium chloride
	0.45%	preservative
	57.95%	water

The dimethiconol included has an average molecular weight of about 280,000 with average particle size of about 160nm, and the level to the concentrate are 0.165% for Examples I, II and IV, and 0.33% for Example III, respectively. \*2

Celquat L-200: Polyquaternium-4 supplied by National Starch and Chemical Corporation

\*3 Polymer 1: Anionic polymer comprising 25% acrylic acid / 75% t-butyl acrylate.

\*4 Polymer 2: Anionic polymer comprising 25% acrylic acid / 65% t-butyl acrylate 10% polydimethylsiloxane having weight average molecular weight of 10,000.

What is claimed is:

1. A hair mousse composition comprising by weight of the concentrate:
  - (a) a silicone emulsion comprising:
    - i) from about 0.01% to about 20% of the concentrate a silicone polymer selected from the group consisting of a polyalkyl siloxane having a molecular weight of at least 20,000, a polyaryl siloxane having a molecular weight of at least 20,000, an amino-substituted siloxane having a molecular weight of at least 5,000, a silicone resin having a molecular weight of at least 5,000, and mixtures thereof;
    - ii) an anionic surfactant;
    - iii) a compatibilizing surfactant; and
    - iv) a cationic surfactant;wherein the silicone polymer is dispersed as a particle having an average size of not more than about 450 nm;
  - (b) from about 0.5% to about 15% of a styling polymer;
  - (c) from about 0.1% to about 15% of an additional surfactant; and
  - (d) from about 60% to about 99% of a solvent comprising by weight of solvent at least about 80% water.
2. The hair mousse composition according to Claim 1 wherein the silicone polymer is selected from the group consisting of a dimethiconol having a molecular weight of at least 100,000, an amodimethicone having a molecular weight of at least 10,000, and mixtures thereof.
3. The hair mousse composition according to Claim 1 wherein the silicone emulsion comprises the silicone polymer dispersed as a particle having an average size of from about 150nm to about 250nm.
4. The hair mousse composition according to any of the claims above wherein the styling polymer is a cationic polymer.

# INTERNATIONAL SEARCH REPORT

Intern. al Application No  
PCT/US 96/17520

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 A61K7/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 95 23581 A (PROCTER & GAMBLE) 8 September 1995 see claims 1-10; examples 1,2 ---	1-4
A	WO 96 32919 A (PROCTER & GAMBLE) 24 October 1996 see claims 1-10 ---	1-4
A	EP 0 529 883 A (UNILEVER) 3 March 1993 see claims 1-13 ---	1-4
A	EP 0 460 683 A (DOW) 11 December 1991 see claims 1-7 -----	1-4

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax (+31-70) 340-3016

Authorized officer

Willekens, G



# INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern. al Application No

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